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93. Proposed by CHARLES CARROLL CROSS, Libertytown, Md.

Given $x^x + y^y = 285$, and $y^x - x^y = 14$, to find the values of x and y . [From *Bonnycastle's Algebra*, 1841.]

*** Solutions of these problems should be sent to J. M. Colaw not later than January 10.

GEOMETRY.

108. Proposed by NELSON L. RORAY, Bridgeton, N. J.

ABC is a triangle. O_1, O_2, O_3 centers of escribed circles. Prove altitudes of triangle $O_1 O_2 O_3$ are concurrent at center of inscribed circle.

109. Proposed by CHARLES CARROLL CROSS, Libertytown, Md.

Two circles, radii in ratio 3:1, centers A and O_1 respectively, are drawn tangent externally to each other and internally to a given circle O , and on the same diameter; O_2 and O_2' are drawn tangent internally to O and externally to A and O_1 ; O_3 and O_3' are drawn tangent internally to O and externally to A and O_2 ; O_3 and O_3' are drawn tangent internally to O and externally to A and O_2 , A and O_2' , respectively; and so on. Prove O_4, O, O_4' ; O_5, A, O_5' ; O_9, A, O_3' and O_{10}, O, O_2' are collinear. [The letters apply to the centers of the circles.]

110. Proposed by P. S. BERG, A. M., Principal of Schools, Larimore, N. D.

If the three face angles of the vertical trihedral angle of a tetraedron are right angles, and the lengths of the lateral edges are represented by a, b , and c , and of the altitude by p , then $1/p^2 = 1/a^2 + 1/b^2 + 1/c^2$. [*Chauvenet's Geometry*.]

*** Solutions of these problems should be sent to B. F. Finkel not later than January 10.

CALCULUS.

83. Proposed by J. SCHEFFER, A. M., Hagerstown, Md.

From a given point, P , in the base AB of a triangle, to inscribe in the latter the minimum triangle, if its angle at P is given.

84. Proposed by C. HORNING, A. M., Professor of Mathematics, Heidelberg University, Tiffin, Ohio.

Find the equation of the curve upon which a given ellipse must roll in order that one of its foci may describe a straight line.

*** Solutions of these problems should be sent to J. M. Colaw not later than January 10.

MECHANICS.

77. Proposed by ELMER SCHUYLER, High Bridge, N. J.

At what elevation must a shell be projected with a velocity of 400 feet that it may range 7500 feet on a plane which descends at an angle of 30° ?

78. Proposed by ALOIS F. KOVARIK, Professor of Mathematics, Decorah Institute, Decorah, Iowa.

A cone and a cylinder having equal heights and equal circular bases are filled with

water; if they have equal holes in the bases, respectively, how many times as long will it take the cylinder to empty as the cone?

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DIOPHANTINE ANALYSIS.

76. Proposed by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Science, Chester High School, Chester, Pa.

It is required to find four positive numbers, such that if each be diminished by twice the cube of their sum the four remainders will be rational cubes.

77. Proposed by JOHN M. COLAW, A. M., Monterey, Va.

Find (1) three consecutive numbers whose sum is a cube, and (2) three consecutive numbers the sum of whose cubes is a cube.

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MISCELLANEOUS.

70. Proposed by WALTER H. DRANE, Graduate Student, Harvard University, 65 Hammond Street, Cambridge, Mass.

Prove $\tan^{-1}x = \frac{1}{2i} \left(\log \frac{x-i}{x+i} \right)$, and thence that $\pi = (2/i) \log(i)$.

71. Proposed by GUY B. COLLIER, 1901 Union, 27 Middle Section of South College, Schenectady, N. Y.

Find the locus of any point on the front sprocket of a bicycle during one revolution of the hind wheel (any gear may be assumed).

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EDITORIALS.

Dr. Halsted reports that the Sylvester Fund has just been finished with about £900.

A copy each of the July number, Vol. II., and the July number, Vol. X., of the *Analyst* is wanted. Any one who can furnish these should write to the editor of the MONTHLY.

A number of important articles will appear in the MONTHLY during the next year. Dr. Miller will continue to furnish original matter on the all-embracing subject of Groups; Dr. E. O. Lovett will continue his series of articles on Lie's Transformation Groups; Dr. Roe has sent in a valuable article on Symmetric Functions, and Dr. Halsted has furnished a highly valuable account of the great Russian mathematician, Tchébychev. This biography will appear accompanied by an admirable picture of Tchébychev.